

# **DIRECT CURRENT BRUSHLESS MOTOR**

## **Background of the Invention**

### **1. Field of the Invention**

The present invention relates to a direct current brushless motor, and more particularly to a direct current brushless motor that may be worked, assembled and manufactured conveniently.

### **2. Description of the Related Art**

A conventional direct current brushless motor structure shown in Fig. 5 comprises a cylindrical base 90 having a through hole (or a chamber) which is formed with a shaft hole 91 in which a rotation shaft of a rotor 92 is rotatably mounted. The base 90 has an outer wall formed with fixing members 93 for combination of coils 94. The base 90 is provided with a control member 95. The coil 94 is magnetically induced with the permanent magnet 96 of the rotor 92, so that the rotor 92 may be driven to rotate.

Another conventional direct current brushless motor structure shown in Fig. 6 comprises a base 80 having a through hole 81 whose one end is provided with a support portion 82. The base 80 has a control member 83, and an even number of coils 84. The base 80 is provided with a positioning member 85 made of magnetically conductive material mounted between two coils 84. The rotor 86 has a rotation shaft rotatably mounted in the support portion 82 of the base 80. The rotor 86 has a permanent magnet ring 87 which has a pole N and a pole S each having a strong magnetic region 88 respectively. Thus, when the rotor 86 stops rotating, the strong magnetic region 88 and the positioning member 85 of the base 80 attract magnetically.

The above-mentioned conventional direct current brushless motor structures need to have even numbers of coils that are fixed on the periphery of the base respectively. Thus, the conventional direct current brushless motor

1 structures need to be wound with even numbers of coils previously during  
2 fabrication, and the even numbers of coils are then fixed on the periphery of  
3 the base respectively, thereby causing inconvenience in fabrication.

#### 4 **Summary of the Invention**

5 The primary objective of the present invention is to provide a direct  
6 current brushless motor that may be worked, assembled and manufactured  
7 conveniently.

8 A secondary objective of the present invention is to provide a direct  
9 current brushless motor that may reduce the cost of fabrication.

10 In accordance with the present invention, there is provided a direct  
11 current brushless motor, including a base having a receiving chamber whose  
12 one end is combined with a cover plate. The other end of the receiving  
13 chamber and the cover plate each have a shaft hole, for pivoting the rotation  
14 shaft of the rotor. A film printed circuit is mounted on the periphery of the base.  
15 The film printed circuit has at least two coil sets, a set of Hall sensing drive  
16 member, and a connecting end for connection with a power supply. The coil  
17 sets of the film printed circuit are oppositely distributed on the periphery of the  
18 base in an equally angular manner with the receiving chamber serving as a  
19 center. After the multiple coil sets are energized, the multiple coil sets and the  
20 permanent magnet ring of the rotor may produce mutually repulsive forces, so  
21 that the rotor may be driven to rotate successively.

22 Further benefits and advantages of the present invention will become  
23 apparent after a careful reading of the detailed description with appropriate  
24 reference to the accompanying drawings.

#### 25 **Brief Description of the Drawings**

26 Fig. 1 is an exploded perspective view of a direct current brushless  
27 motor in accordance with a first embodiment of the present invention;

Fig. 2 is an exploded perspective view of a direct current brushless motor in accordance with a second embodiment of the present invention;

Fig. 3 is a top plan cross-sectional assembly view of the direct current brushless motor as shown in Fig. 1;

Fig. 4 is a top plan cross-sectional assembly view of the direct current brushless motor as shown in Fig. 2;

Fig. 5 is an exploded perspective view of a first conventional direct current brushless motor in accordance with the prior art; and

Fig. 6 is an exploded perspective view of a second conventional direct current brushless motor in accordance with the prior art.

#### **Detailed Description of the Preferred Embodiments**

Referring to the drawings and initially to Fig. 1, a direct current brushless motor in accordance with the first embodiment of the present invention comprises a base 1, a film printed circuit (F.P.C.) 2, and a rotor 3.

The base 1 may be a housing of a motor, a heatsink fan or the like. the base 1 has a receiving chamber 11 whose one end is formed with an opened end, so that the rotor 3 may be received and rotated in the receiving chamber 11. A cover plate 12 is then mounted on the opened end of the receiving chamber 11. If necessary, the cover plate 12 may be fixed on the base 1 by various fixing manners. Each of the cover plate 12 and the base 1 has a shaft hole 13 for pivoting the rotation shaft 31 of the rotor 3. In the preferred embodiment, the shaft hole 13 may be fitted with an abrasion-proof member such as a bearing, a bushing or the like, so that the rotation shaft 31 of the rotor 3 may be rotatably mounted in the abrasion-proof member. The base 1 has an outer wall formed with multiple receiving holes 14 for sinking and receiving the film printed circuit 2.

1 The film printed circuit 2 has at least two coil sets 21, and a set of  
2 Hall sensing drive member. The set of Hall sensing drive member includes a  
3 Hall sensor 22, and a drive member 24, and has a connecting end 25 for  
4 connection with the power supply. The film printed circuit 2 additionally has a  
5 fixing magnetic member 23 that is made of magnetically conductive material.  
6 The film printed circuit 2 is enclosed and wound around the periphery of the  
7 base 1. If necessary, the film printed circuit 2 may be sunk and received in the  
8 receiving holes 14 of the base 1. Each of the coil sets 21 of the film printed  
9 circuit 2 are oppositely distributed on the periphery of the base 1 in an equally  
angular manner with the receiving chamber 11 serving as a center.

10 The rotor 3 has a rotation shaft 31 having two ends each rotatably  
11 mounted in the shaft hole 13 of the base 1 and the cover plate 12 respectively.  
12 The rotor 3 has a permanent magnet ring 32. The rotation shaft 31 and the  
13 permanent magnet ring 32 are connected by blades 33. Thus, when the rotor 3  
14 is rotated, the air may be driven to flow. The permanent magnet ring 32 has  
15 poles N and S. The permanent magnet ring 32 is formed at least two interface  
16 regions 321. Between the two interface regions 321 are poles N and S. The  
17 intermediate positions of the poles N and S are the strong magnetic regions 322.  
18 When the rotor 3 stops rotating relative to the film printed circuit 2, one of the  
19 strong magnetic regions 322 of the permanent magnet ring 32 and the fixing  
20 magnetic member 23 of the film printed circuit 2 may produce an attractive  
21 action, thereby forming a positioning and stopping action, so that the rotor 3 is  
22 easy to start at the next starting action.

23 Referring to Fig. 3, the direct current brushless motor in accordance  
24 with the first embodiment of the present invention is assembled. The film  
25 printed circuit 2 is enclosed and wound around the periphery of the base 1, and  
26 each of the coil sets 21 of the film printed circuit 2 are oppositely distributed on  
27

1 the periphery of the base 1 in an equally angular manner with the receiving  
2 chamber 11 of the base 1 serving as a center. The rotor 3 may be placed into the  
3 receiving chamber 11 of the base 1. Thus, when the connecting end 25 of the  
4 film printed circuit 2 is electrically connected to the power supply, the poles N  
5 and S of the permanent magnet ring 32 of the rotor 3 and each of the coil sets  
6 21 of the film printed circuit 2 may produce mutually repulsive magnetic  
7 forces. The Hall sensor 22 may detect variation of the poles N and S of the  
8 permanent magnet ring 32 of the rotor 3, thereby varying the magnetic force  
9 produced by the coils 21. Thus, the rotor 3 may be driven to rotate successively.  
10 When the electric power to the connecting end 25 is stopped, the rotor 3 stops  
11 rotating, the strong magnetic region 322 of the permanent magnet ring 32 of  
12 the rotor 3 and the fixing magnetic member 23 of the film printed circuit 2 may  
13 produce an attractive action, thereby forming a positioning and stopping action,  
14 so that the rotor 3 is easy to start at the next starting action.

15 Referring to Figs. 2 and 4, the direct current brushless motor in  
16 accordance with the second embodiment of the present invention is shown.  
17 The rotor 3 is placed into the receiving chamber 41 of the base 4, and a cover  
18 plate 42 is secured on and combined with the base 4. Each of the cover plate 42  
19 and the base 4 has a shaft hole 43 for pivoting the rotation shaft 31 of the rotor  
20 3. The base 4 has a periphery provided with recesses 44, for receiving the film  
21 printed circuit 2, and each of the coil sets 21 of the film printed circuit 2 are  
22 oppositely distributed on the periphery of the base 4 in an equally angular  
23 manner with the receiving chamber 41 of the base 4 serving as a center. Thus,  
24 the film printed circuit 2 may be protected by the base 4, and may obtain a  
25 better positioning provision.

26 Accordingly, in the direct current brushless motor in accordance with  
27 the present invention, each of the coil sets and a set of Hall sensing drive

1 member are formed on the film printed circuit 2, thereby reducing respective  
2 mounting and positioning of each of the coil sets. Thus, fabrication of the  
3 direct current brushless motor may be made more simple and convenient, and  
4 cost of fabrication may be reduced. Further, by provision of the fixing  
5 magnetic member of the film printed circuit, when the rotor stops rotating, the  
6 strong magnetic region of the permanent magnet ring of the rotor and the  
7 fixing magnetic member of the film printed circuit may produce an attractive  
8 action, thereby forming a positioning and stopping action, so that the rotor is  
9 easy to start at the next starting action.

10 Although the invention has been explained in relation to its preferred  
11 embodiment as mentioned above, it is to be understood that many other  
12 possible modifications and variations can be made without departing from the  
13 scope of the present invention. It is, therefore, contemplated that the appended  
14 claim or claims will cover such modifications and variations that fall within the  
15 true scope of the invention.